European Journal of Applied Physics
Vol 6 | Issue 2 | March 2024
ISSN 2684-4451

RESEARCH ARTICLE

Quantum Propulsion: Background and Practical Applications

Alex Ioskevich*

ABSTRACT

This is the first introduction of new and revolutionary aerospace engines and propulsion methods. Our organization is currently developing quantum propulsion systems and space vehicles that will be capable of flying with enormous speed (potentially reaching and exceeding the speed of light) and will have unseen-before manoeuvrability and lifting capacity. They will provide 100% crew protection from deadly sun and space radiation which is essential for safe deep space travel and manned space exploration. They will also provide spacecraft with protection against space particles. To date, we have managed to crack the main secret of practical quantum engine design and we are ready to develop it further into fully operational aerospace vehicles. Quantum propulsion systems are the only systems that can facilitate realistic prospects of space mining on the industrial scale and deep space colonisation, including colonisation of habitable planets in the future. The cost efficiency of this new technology is going to be enormous. Development and production costs of quantum aerospace vehicles compared to production costs of chemical fuel jet spacecraft allow to reduce price per kilo space launch ratio hundreds of times, making deep space exploration and commercialisation more accessible and practically feasible at last. Manufacturing and maintenance of quantum-propelled flying machines that can reach the age of our solar system within hours will be no more expensive than manufacturing jet planes or helicopters of the same size. Quantum propulsion systems are going to replace outdated chemical fuel rocket and jet engines in the near future and will become the mainstay of air travel and space exploration.

Keywords: Interstellar Travel, Protection from Space Radiation, Quantum Propulsion Systems, Superluminal Speed of Space Travel.

Submitted: December 12, 2023

Published: March 07, 2024

10.24018/ejphysics.2024.6.2.294

Independent Researcher, UK.

Corresponding Author:
e-mail: intstelforce@mail.com

1. Introduction

Present-day aerospace technology is in a deep crisis. The speed and lifting capacity of modern airplanes and spacecraft is notoriously limited with no prospects of improvement. The chemical fuel rocket and jet engines played their historical role well, but they have no prospects of improving. Quantum Propulsion Technologies Ltd. team is developing new types of propulsion systems and space vehicles that will revolutionize air travel and space exploration. They will act as the next stepping stone in the development of our civilization and will completely replace chemical fuel engines in 10–20 years.

This new development is a result of a scientific discovery and a technical invention that we have made recently.

Both from a scientific point of view and as a need to discover new sources of essential resources, exploring beyond our own planet is one of the remaining great missions for humanity. However, this is not without challenges, and as we look beyond the Moon to larger, more distant bodies, those challenges have become roadblocks to progress.

Whether used in the atmosphere or space, the chemical fuel rocket propulsion that has taken us this far has reached its practical limits. In terms of the thrust that can be generated, the speeds possible and the fuel needed, existing technology is something that must be worked around, rather than a driving

Copyright: © 2024 Ioskevich. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original source is cited.

force to achieve new goals. Even with technological breakthroughs such as fusion reactors, the jet engine-powered craft will struggle to exceed even 50 km/sec speeds, while lifting capacity will remain severely limited too, presenting limiting performance on any future plans using the outdated propulsion systems that produce thrust by expelling reaction mass i.e., burned fuel shot backwards to provide acceleration.

Our current technology is only viable for manned flights to the moon and Mars, and even then, with significant compromises in how much equipment and how many people can be transported at once. But we should already be planning for longer journeys, reaching asteroids for the minerals they offer, new planets for the possibilities of settlements and more. Even travel between countries remains a barrier to trade, with flights being both expensive and a little faster than they were half a century ago, with severe limitations on the weights that can be realistically transported.

As we seek to push further away from our planet, speed becomes more than a hindrance, but instead is the thing that defines what we can do as humans. Distances become so vast, so quickly, that time taken to travel to bodies within our solar system, or further afield, dictates the kind of missions that can be attempted, and the kind of vehicles needed to accomplish them. Without a dramatic change in the speeds possible for our spacecraft, even the nearest stars become not a journey of exploration, but an impossible dream. With the human body having physical problems after 2 years in a weightless environment and deadly space radiation, travel beyond that remains impractical. Currently, that means no further than Mars. If we want to go further, and eventually we must go further, then we must travel faster. Much faster.

It is imperative then that our technology keeps up with the needs of not just space exploration, but the world around us. Providing fast, cheap transport around the globe can bring about a sea-change in how we live, boosting the life experience of every human being on the planet. The question has long been what kind of engine will drive this change, and we are proud to say that having taken the first steps into this new world, the answer is Quantum Propulsion Systems.

2. Method: Quantum Bubble Propulsion–More Than A Theory

The idea behind quantum propulsion or electromagnetic propulsion has been around for a while, clean, cheap and very fast, it has been the panacea for a modern propulsion system both in the atmosphere and out in space. But recent research has brought that idea much closer to reality, with the discovery of the physical principles of the quantum vacuum cocoon motion, often referred to as the quantum bubble propulsion. Its full name is *Hyper-Relativistic Local-Dynamic Space Motion*. This concept was originally suggested by Albert Einstein, although there have been several detailed works about this space travel method since. Initially, in 1994, *The Warp Drive: Hyper-fast Travel Within General Relativity* [1] was a groundbreaking work on the subject by quantum physicist Miguel Alcubierre, and this has been built on in recent years, notably by *Hyper-fast positive energy warp drives*, by Lentz [2], *Physics of Field Propulsion: Outline of Quantum Field Theory and Its Applications for Space Propulsion* by Bobrick and Martire [3] published in 2018–2023 and some others.

The most groundbreaking work on the subject is the theoretical research and practical analysis of proposed interstellar travel methods undertaken by Mario J. Pinheiro and Takaaki Musha, world-renowned leaders in the field, and their seminal work *Physics of Field Propulsion: Outline of Quantum Field Theory and Its Applications for Space Propulsion* [4]. In the last couple of years, Mario J. Pinheiro has continued to build on this incredible research, with *New Framework to Study Electromagnetic Turbulence* [5], *Advanced Topics in Contemporary Physics for Engineering: Nanophysics, Plasma Physics, and Electrodynamic* [6] and finally *Advances in Engine Efficiency: Nanomaterials, Surface Engineering, and Quantum-based Propulsion* [7] all taking the idea of practical applications of quantum propulsion further than ever before.

The practical method for forming a quantum vacuum cocoon involves manipulating and controlling the physical mass of an object. This ability allows us to approach Albert Einstein's famous equation, which illustrates the equivalence between mass and energy, from a different perspective. The equation is as follows:

$$E = mc^2$$

This equation leads to a function indicating that the faster we travel, the more energy is required for acceleration in our pursuit of reaching the speed of light. While it suggests that getting very close to the speed of light is possible with a fantastically tremendous amount of fuel, achieving the actual speed of light remains unattainable. As we approach the speed of light, the mass and kinetic energy of the vehicle increase, demanding more and more fuel for further acceleration (see Fig. 1):

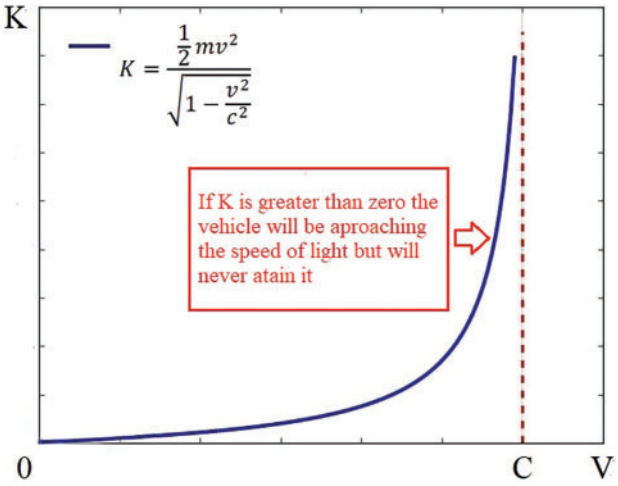
K
$K = \frac{\frac{1}{2}mv^2}{\sqrt{1-\frac{v^2}{c^2}}}$
If K is greater than zero the vehicle will be aproaching the speed of light but will never atain it
0
C
V

Fig. 1. Conventional spacecraft: K is a positive value.

$$K = \frac{\frac{1}{2}mv^2}{\sqrt{1-\frac{v^2}{c^2}}}$$

where
c–speed of light,
v–speed of the vehicle,
m–mass of the vehicle,
K–kinetic energy of the vehicle.

However, everything changes when we gain control over the vehicle's mass, keeping it at zero point. This implies the ability to maintain the kinetic energy of the vehicle at zero point as well. Consequently, we can accelerate the vehicle to the speed of light instantly with minimal applied energy. This control allows us to reach any required speeds, surpassing the speed of light thousands of times, and to bring the vehicle to a standstill at will without significant energy input. Thus, spacecraft equipped with quantum propulsion systems will be capable of bypassing thousands of light-year distances in a few minutes (see Fig. 2). Here is the same equation where m = 0:

$$K = \frac{\frac{1}{2}0v^2}{\sqrt{1-\frac{v^2}{c^2}}} = 0$$

Therefore, mastery over the mass of space vehicles grants us the capability to fully control the spacecraft's space-time motion, paving the way for unrestricted interstellar travel.

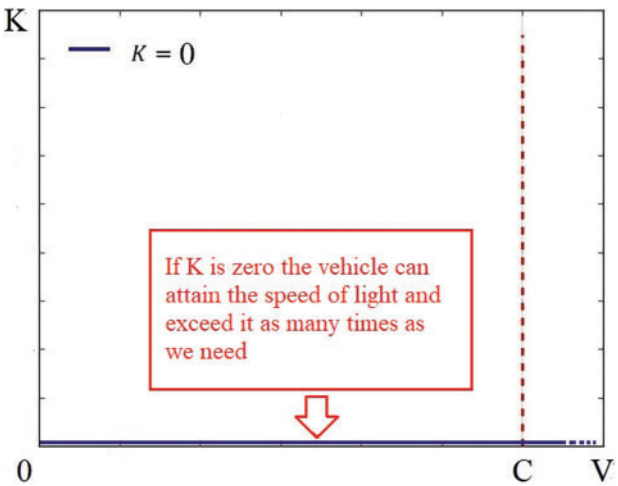

Fig. 2. Quantum vacuum cocoon-protected vehicle: K is zero.

3. The Concept of Hyper-Relativistic Local-Dynamic Space Motion, or Quantum Propulsion

With so much research moving this concept forward rapidly, it is important to understand the theory and how that translates into a practical, effective solution for motive power. The basic operating principle of any quantum propulsion system is the generation of a quantum vacuum cocoon, or a quantum bubble, around a vehicle. This quantum cocoon dissolves any quantum connections between physical particles and fields around the vehicle and thus isolates this vehicle from the influence and resistance of the outside physical environment and physical fields. It forms a sphere of absolute vacuum around the vehicle where no material object of field can exist and function in its normal form.

The result is a vehicle with no theoretical speed limitations at all, and maneuverability on a scale never seen. The nature of the quantum bubble means that this doesn't just fly in space but could just as easily be used for atmosphere flight. Aerospace vehicles with no speed limits and incredible cost-efficiency make it possible to travel thousands of miles in a few seconds. You can begin to see the potential for transforming our entire way of life, not just space travel. But perhaps the most remarkable thing about quantum propulsion is that while it sounds like something straight off the pages of a sci-fi novel, it is something that already exists in nature. Many flying insects and spiders have been using their own internal electromagnetic mechanism to achieve the same concept almost since life first began on Earth, and still do today.

So, like the early attempts at flight using principles that mimicked birds' aerodynamics, our journey to quantum propulsion is grounded in reverse engineering nature, and a better understanding of how insects produce and harness their own quantum cocoon. Analysis shows that insects today use a combination of propulsion methods, using more traditional aerodynamic flight modes for take-off, landing and hovering above flowers, switching to the quantum mode for rapid progress parallel to the ground or when hovering in readiness for fast movement, such as if they sense any kind of danger or preparing for acceleration to their cruising speed.

Insects generate their electromagnetic cocoon through a difference in electrical potential between the body and rapidly vibrating wings. That cocoon is strong enough to disrupt quantum connections, forces and quantum fields in the immediate space around the insects allowing them to glide in the electromagnetic field ignoring dynamic air resistance, gravitation influence and possible dust particle impacts. In some cases, such as spiders, the cocoon is created by increasing the electrical potential extended from their body antenna, relying on interaction with Earth's electromagnetic field to move. Some spiders can travel thousands of miles using this passive method.

Our team is the first group of engineers on the planet that have recreated this effect by means of electromechanical devices and holds IP for this invention. We are currently working on the development of the flight control system, aiming to build reliable and effective aerospace propulsion systems and vehicles. Through these experiments in replicating the quantum cocoon and unleashing the potential of rapid transit as a result, we believe that we have unlocked the true nature of matter and mass. Our experiments show that it is the combination of black matter and black energy that forms the foundation of the universe, with visible matter and its electromagnetic and gravitational fields at the top, alongside some yet unknown fields. All those fields and energies are interacting and displaying significant interdependence.

Every material object is formed of quantum particles that in their turn are formed by high-frequency oscillations of various known and unknown physical fields. Hence, oscillations form matter and its quantum gravitational fields that also form gravitational connections between objects and inside of these objects, thus shaping the main substance of the matter that we perceive as the tangible material objects being discussed. If we then try to move and accelerate these objects, whatever they may be, we experience natural resistance or friction between the static universal fields and the net of quantum connections inside of the accelerating objects, forming an initial resistance to the movement called inertia that represents the main attribute of mass. That resistance is how we define mass and as we propose to understand it today.

To look at these processes differently, think of the mass as quantum windage, the quantum gravity connections and other fields as the sail that resists the air, while the combination of universal static fields forms the air that resists or compels movement. In our experiments with quantum cocoons, our generator emits an unknown until now form of energy that we have decided to call Q-Force. This Q-Force disturbs or completely eliminates oscillations of the physical fields, temporarily dissolving matter and its quantum connections around the Q-force generator and the flying machine, making it "invisible" to the surrounding matter and fields themselves, extinguishing quantum windage resistance, thus eliminating inertia effect and as a result the mass of the generator and the vehicle that it's propelling.

The outcome of this is unlimited, frictionless movement in any direction and at any speed, including luminous and super-luminous speeds. Any vehicle using this system can be accelerated rapidly, then

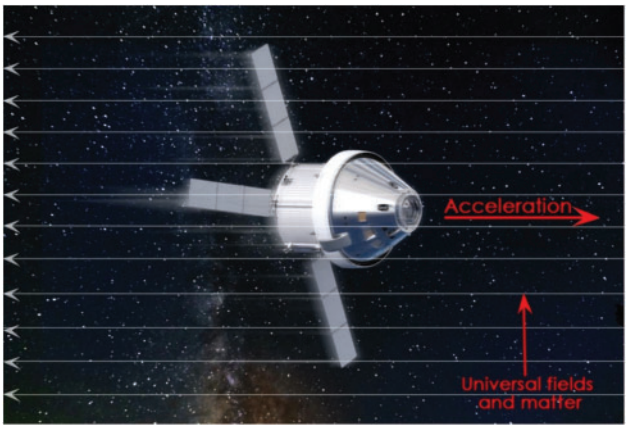

Fig. 3. Conventional spacecraft.

brought to a standstill immediately ignoring inertia and resulting G-forces, all requiring minimal energy to be applied to instigate and stop the movement. We have decided to express Q-Force as a percentage, for instance, a quantum generator that produces 80% of Q-Force will eliminate 80% of the mass and air resistance around the space vehicle, and so on. Of course, a 100% Q-Force renders any vehicle immune to surrounding matter and completely "switches off" its mass, so it becomes totally unaffected by any gravitational fields and momentum forces.

That 100% Q-Force is what we consider to be the perfect quantum bubble or cocoon, creating its own dimension within the bubble, separate yet within our own dimension. Inside this cocoon, the vehicle is unmoving, and completely static, when force is applied, it is the cocoon itself that moves. The vehicle is static within its own dimensional bubble, even when the bubble itself moves within our dimension. Occupants of the vehicle inside that cocoon are therefore not subject to the acceleration and movement forces we expect, as in their cocoon, they remain entirely static.

It is this phenomenon that makes quantum propulsion so important for not just space travel, but rapid transportation of all kinds. Unlike some aerospace companies that are looking for ways to fight or eliminate gravity, we are approaching the issue of electromagnetic propulsion from the opposite side. We are not trying to eliminate gravity, instead, the Q-force generator is eliminating the mass of the spacecraft, thus making it "invisible" to gravity and any other physical fields and forces. That is the ultimate solution to the problem of rapid, safe and efficient travel to cope with our future needs, whether that is transportation between planets and star systems or across continents on Earth. We propose to call this definition of mass the Quantum Windage Theory, and alongside our continuing work on the application of these concepts, we are also seeking to initiate a robust scientific debate about the Quantum Windage concept and the possibilities it offers for the development of new technologies.

This is an accelerating conventional spacecraft that, like any other material object, is fighting its own mass inertia burning tons of chemical fuel (see Fig. 3). This resistance, which we call inertia, is the result of friction between quantum particles and their gravitational interconnections of the object's own body and the static energy fields of the universe. The physical phenomena, which we call mass is nothing more than this friction or "quantum windage" as we proposed to call it. If we manage to eliminate this friction, i.e., inertia, we effectively make the mass of the object unrecognisable by the surronding matter and fields resulting in absolute freedon of speed and manoeuvre (see Fig. 4).

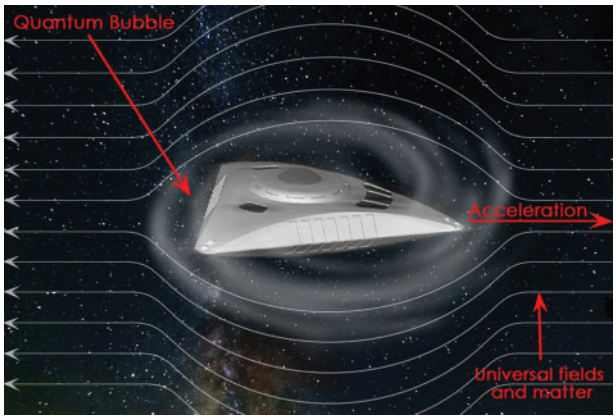

Fig. 4. Quantum propulsion system powered spacecraft flight–no quantum friction, no inertia effect.

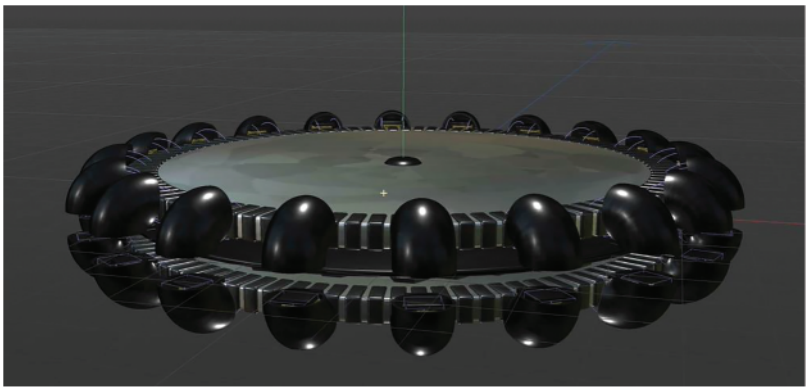

Fig. 5. The main core of quantum propulsion system: Q-force generator (holding frame, piping and cabling not shown).

Thus, when the quantum generator of the propulsion system is on and at 100% power (see Fig. 5), the space vehicle glides via the energy-free tunnel, forming it by generating a quantum vacuum bubble around itself that conveniently isolates the vehicle from the surrounding chemical environment and combination of universal energy fields (see Fig. 6). If we apply a controlling impulse to one side of the bubble, we will effortlessly accelerate the bubble and the vehicle inside the bubble to any speed including speed of light. Thus, electromagnetic impulses of predefined frequency and configuration will provide these vehicles with propulsive and flight control momentum.

4. Our Roadmap to Quantum Propulsion

Our research and development are continuing under the business identity trademarks of Quantum Propulsion Technologies Ltd., operating both short- and long-term programs that aim to deliver real-world applications of the concept. This begins with the design, development and testing of the first workable and fully operational quantum propulsion system-propelled prototype within the next two to three years. This initial prototype will operate as proof of concept, demonstrating the many advantages of quantum propulsion systems for both our potential investors and our potential customers alike.

Once the first fully operational vehicles have been built, that proof of concept will be further developed into a commercially viable high-speed and highly maneuverable drone. With potential use applications including surveying and any other visual observation (including military and law enforcement intel gathering) or as a highly efficient and fast weapon delivery platform, this initial product should see high demand and deliver funding to move towards our longer-term goals.

Building on those initial drone applications, more advanced versions could be used to launch satellites into LEO, dramatically reducing costs for any space launch, but the ability to carry higher loads at almost any speed would also make them eminently suitable for deep space exploration. Delivering sets of scientific instruments and surveying planets, asteroids and more, these drones could be the vanguard in our full-scale exploration of our solar system planets, as well as in scouting asteroids for much-needed minerals.

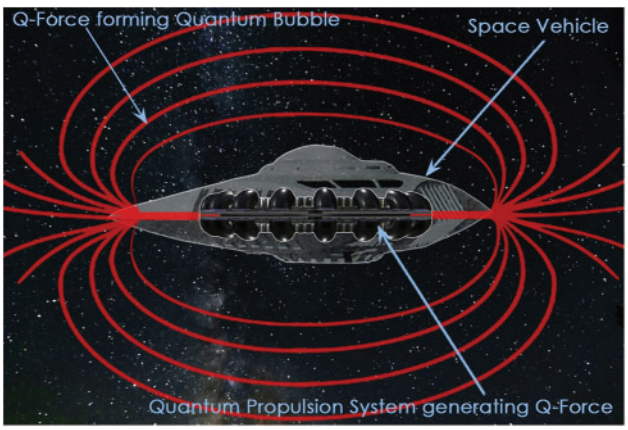

Fig. 6. Quantum propulsion system generates a Q-force field around the spacecraft forming two safe half-spheres around the vehicle and inside of the bubble, the physical properties of matter and fields inside of those half-spheres remain undisturbed.

Beyond our initial 5-year development cycle, Quantum Propulsion Ltd. expects to develop more tailored vehicles to suit business needs. We expect the first of these to be a four-seater manned spacecraft that we will design, develop and launch within a decade. These vehicles could be used for scientific interplanetary space exploration, space tourism, Astro-geological surveys, experimental small-scale asteroid mining operations within our solar system and as a basis for building various types of versatile military aerospace vehicles.

Continually moving forward, these first small, manned craft will pave the way for larger space vehicles offering high-capacity transport spaceships that will be capable of supporting industrial-scale commercial space mining operations and the construction of planetary bases within our solar system. Lessons learned during these developments will lead on to the ultimate goal of these projects, large interstellar transport spaceships that could be used for the exploration of distant planetary systems and colonization of habitable planets, with the first prototypes appearing within twenty years.

5. Quantum Propulsion as Part of a New Human Culture

Alongside Quantum Propulsion Ltd. we also operate Intstelforce Ltd., which is tasked with placing these technological advancements within our society and ensuring that these dramatic changes in capability translate into tangible benefits for all. Intstelforce Ltd. will act as an initiator of all future space mining and space colonization projects, including habitable planets colonization as the technology progresses.

Currently, we have launched our New Earth Project under the Intstelforce Ltd. umbrella. This project sets out to create an international think tank, uniting young people looking to create a new, politically independent, planet-state on the surface of one of the habitable planets that quantum propulsion will put within our reach. The prime task of the New Earth project group is to devise the most appropriate and efficient methods of scouting for new planets suitable for habitation. That includes consideration of various aspects of this venture such as climatic, tectonic and biological conditions, and drawing up appropriate plans for the colonization process. This includes ideas about the economic and political organization of the new planet-states and the most efficient ways of governing them. While this may seem a little advanced, it is important to remember that once quantum propulsion is achieved, the speed of colonisation will be extremely rapid. Our large transportation spacecraft will be capable of transporting hundreds of thousands of people to the other planetary systems and issues like governance and sustaining of new worlds and communities must be in place and ready to go.

6. Results: Quantum Propulsion in Practice, What can we Expect?

Like all new technologies, and especially those that offer a breakthrough in how we understand and interact with the world around us, quantum propulsion sounds both exciting and wonderous. But it is not the technology itself that really matters in the end, but in what that technology does for our lives. For instance, television broadcasts are not amazing because of the physics behind how data is transmitted and turned into moving images, but that it changed the way the entire world consumes entertainment and information. Television changed the way we live, and the crucial thing about quantum propulsion is that it will do the same.

Before looking at the wider impact, it is important to go through the very clear advantages of quantum propulsion systems and why they offer such a leap in capability compared to the current reliance on chemical fuel engines.

1. **Unlimited Speed:** Theoretically it is possible to achieve the speed of light from the outset, and potentially master superluminal warp drive motion speeds, making these vehicles perfectly suitable for feasible interstellar superluminal travel and the nearest planetary systems exploration.
2. **Highly Maneuverable:** Rapid acceleration and sharp-angle changes in direction are possible as neither the vehicle nor crew are subject to any kind of inertia influence and G-force within the quantum cocoon.
3. **100% Crew Protection:** Because the vehicle and crew sit within their own quantum cocoon, in effect in a separate dimension to the world around them, they are isolated from any kind of radiation encountered in space. In addition, because of their enormous lifting capacity, these vehicles can be constructed with heavy metallic armor that will be able to protect the crew against this radiation when the propulsion system is off (while on the surfaces on the celestial bodies that don't have any atmosphere for example), with no penalty for movement or energy use.

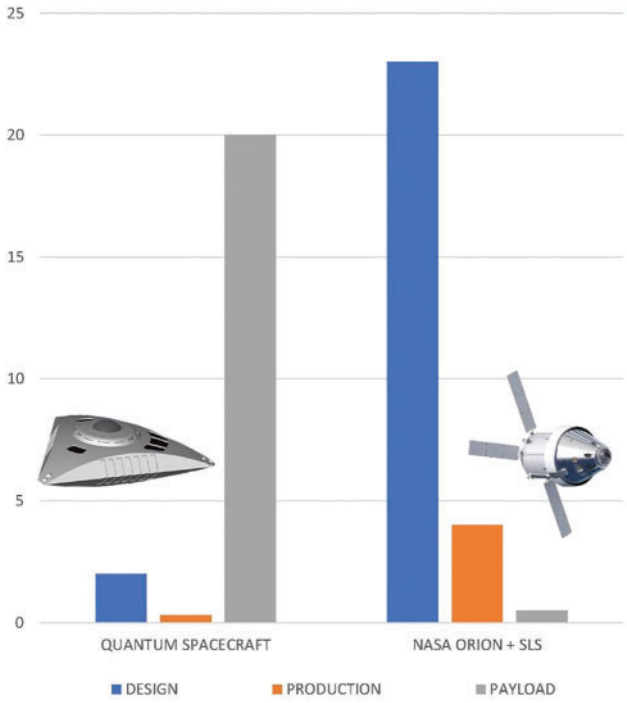

Fig. 7. Orion + SLS spacecraft combination and QPS spacecraft cost comparison in billions USD (Moon exploration configuration).

4. **Enormous Load Capacity:** Within the quantum cocoon the vehicle and its contents are in effect zero weight while the system is active. As a result, the load capacity of the vehicle is restricted only by its cargo bay size.
5. **Zero Aerodynamic and Hydrodynamic Resistance:** Vehicles equipped with quantum propulsion systems can fly at any speed ignoring atmospheric and water resistance, ignoring space particles and other destructive impacts and interstellar gas cloud abrasion that could risk alternative solutions.
6. **Highly Efficient:** Without the need for rocket boosters or large amounts of reaction mass i.e., propelling substances for expulsion, a quantum powered space vehicle will be able to accelerate from the Earth surface directly into the open space and to attain any speed at will. These vehicles don't require any chemical fuel or any other waste products. These propulsion systems don't emit anything, they are 100% green and environmentally friendly. Q-force generator can be powered by ferromagnets that could be replaced or recharged once in 3–5 years. There is also no need for huge numbers of personnel to oversee any flight, the vehicles are going to be mechanically simple and completely autonomous, with the flight preparations and the ground control no more complex than flight preparations and control of a small private jet plane or helicopter. This also means there is no need for expensive runways and spaceports thanks to the 100% VTOL capability of these craft.
7. **Extremely Cost Effective:** Dramatically lower production costs compared to chemical fuel space vehicles, which allows significantly lower price per kilo space launch ratio. The manufacturing and maintenance of vehicles equipped with quantum propulsion systems will be no more expensive than manufacturing of jet planes or helicopters of the same size (see Fig. 7). Building a combination of Orion NASA spacecraft with SLS costs more than 4 billion USD. They both are expandable vehicles, and they can be used just once. Building reusable QPS-equipped spacecraft will cost just about 500–600 million USD and it will be capable of performing 200–300 flights before any major refurbishment. The difference is absolutely staggering.

7. Putting Quantum Propulsion into Practice

When developing this new system, the goal is to deliver a mature, functional solution that has practical applications. In terms of commercial uses, there are several options here. Primarily, the quantum propulsion system will unlock the opportunity for asteroid and interplanetary mining, allowing access to resources for human development in a way that does not harm our planet and home. As we deplete resources on Earth, this is perhaps the only option to maintain the society and way of life we have created, and as such is crucial for the future of the entire human race.

Currently, scientists believe that it is impractical and commercially unviable to use traditional rocket-propelled vehicles for this type of mining. Prohibiting cost, travel times and the lack of load capacity mean that space mining by means of conventional rocket engine-propelled spacecraft is not commercially feasible. It seems then, that quantum propulsion is the only viable option for providing society with the natural resources it needs. This kind of mining will have a huge effect throughout the world too, as it dramatically shifts resource prices downwards, helping poorer communities and ensuring that everyone can have the things they need for a good quality of life.

However, while the importance of such initiatives cannot be overstated, there are other applications that will have a significant effect on the way we live too. The speed and unprecedented maneuverability of a vehicle contained within a quantum cocoon make them incredibly valuable for military applications. Combined with AI control you can have aircraft that are much faster, more agile and carry much heavier weapon payloads, all in a single craft. They could perform maneuvers that would be physically impossible for a conventional aircraft due to immunity to G-Forces and would be superior to any fighter plane operating on the planet.

Further space exploration requires large, fast vehicles, and quantum propulsion is the key to creating spacecraft fast enough to reach any planets in our solar system, and eventually other stars, in timescales that are survivable for its crew. This exploration will transform the way we see the universe around us, opening up new opportunities for settling on other planets, creating new independent planet-states, and creating interplanetary corporations and markets.

But it is not just in space where the changes made possible by quantum propulsion will manifest. Imagine a world where a flight from London to Sydney or LA takes less than half an hour and is cheaper than your taxi fare to the airport right now. Shrinking the world in this way, and making easy travel, anywhere, accessible to all, will be the spark for the next industrial revolution. Incomes will be boosted for all as new opportunities become available, and we can focus on value, rather than securing our share limited by the size of the planet's resources. It is transformational technology in every way, unleashing a tidal wave of potential both on Earth and in space.

8. Conclusion

In the same way that steam power transformed our world in the first industrial revolution, quantum power will push the next. We will live in a world where anywhere is just a few minutes' journey away, and that journey is affordable for all, not locked behind a barrier that only the richest can afford. People will be able to easily commute anywhere, maximizing their skills and knowledge, boosting careers and opening new opportunities to all, regardless of where they are born.

But it will also do so much more, bringing other planets, asteroid resources and even other star systems within reach. Humanity will be limited only by our imagination and will to explore, and it all began with an insect, an idea and our passion for technology.

Conflict of Interest

Author declares that there is no conflict of interest.

References

[1] Alcubierre M. The warp drive: hyper-fast travel within general relativity. *Classical Quant Grav*. 1994;11(5):L73–7.
[2] Lentz EW. Hyper-fast positive energy warp drives. *16th Marcel Grossman Meeting*, 2023.
[3] Bobrick A, Martire G. Introducing physical warp drives. *Class Quantum Gravi*. 2021;38(10):105009.
[4] Pinheiro MJ, Musha T. *Physics of Field Propulsion: Outline of Quantum Field Theory and Its Applications for Space Propulsion*. LAP LAMBERT Academic Publishing; 2016.
[5] Pinheiro MJ. New framework to study electromagnetic turbulence, arXiv:2202.05840 [physics.class-ph]. 2022.
[6] Pinheiro MJ, Lobo RFM. *Advanced Topics in Contemporary Physics for Engineering: Nanophysics, Plasma Physics, and Electrodynamic*. Taylor & Francis Ltd.; 2022.
[7] Pinheiro MJ. Advances in engine efficiency: nanomaterials, surface engineering, and quantum-based propulsion, arXiv:2307.02490 [physics.gen-ph]. 2023. Available from: https://arxiv.org/abs/2307.02490.